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## (54) IMPROVEMENTS RELATING TO FLOOR COVERINGS

(71) We, DUNLOP HOLDINGS LIMITED (formerly The Dunlop Company Limited), a British Company of Dunlop House, Ryder Street, St. James's, London, S.W.1., do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:

This invention relates to floor coverings.

According to the present invention, a floor covering comprises a surface sheet of cellular plastics material which has been compressed biaxially by compression forces acting in or parallel to the plane of the sheet and retained in the compressed state by means of cross-linkage of the plastics material subsequent to compression or by means of an adhesive in the sheet or by heat-setting the plastics material or by means of a sheet material adhered to a face of the sheet.

According to a further aspect of the invention, a method of making a floor covering comprises compressing biaxially a surface sheet of a cellular plastics material by compression forces acting in or parallel to the plane of the sheet and retaining the structure in its compressed state by means of cross-linkage of the plastics material or by means of an adhesive in the sheet or by heat-setting the plastics material or by means of a sheet material adhered to a face of the sheet.

The sheet of cellular plastics material may be the only sheet material in the floor covering or it may be a surface sheet in a laminate with one or more other sheet materials. It is to be understood that the outer surface of the sheet of cellular plastics material may have a coating or finish based on, for example, a plastics material or other polymer. An example of an adhesive in the sheet is a polymer latex adhesive composition impregnant.

The cellular plastics material is preferably a polyurethane foam, although other plastics foams, preferably open-cellular foams, may be used, for example those of poly(vinyl chloride), polyethylene or polypropylene. The cellular material is advantageously a reticulated foam. If desired, the cellular plastics material may have a coating of another plastics material, e.g. a polyurethane foam having a poly(vinyl chloride) or polyethylene coating, on at least some of the cell walls.

The biaxial compression forces are preferably mutually perpendicular and coplanar, and the degree of compression may be different in both directions but it is often preferred that it is the same in both directions.

The cellular plastics material is preferably a coarse pore foam; for example having 10 to 40 pores per inch prior to compression. The density prior to compression may be up to 6 lb/cu.ft and is preferably 1½ to 4 lb/cu.ft. The degree of compression may be such as to reduce the surface area by up to 9 times and preferably 2 to 6 times. The thickness of the cellular material will depend upon the nature of the material but is preferably 0.04 to 0.25 inch.

The compression forces may be obtained by stretching an elastic sheet material, adhering the cellular material to the stretched sheet using an adhesive composition or other adhering means, e.g. spikes protruding from

the elastic sheet, and subsequently releasing the stretching forces on the elastic sheet to cause compression of the foam. The elastic sheet may then be removed or it may remain in the finished floor covering, either as a backing or as an intermediate layer between the compressed cellular plastics material and a backing. Suitable elastic sheet materials are sheets of elastomeric material, for example natural, synthetic or silicon rubbers or stretch-fabric. Although the use of an elastic sheet is found to be suitable, it will be appreciated that other means of compression may alternatively be employed.

The floor covering may be provided with an abrasion-resistant polymer finish, for example poly(vinyl chloride), polyurethane or polypropylene, and/or may be decoratively finished, e.g. by embossing.

The invention is illustrated in the following specific Examples.

*EXAMPLE I*

A light elastic rubber sheet, 1/16 inch thick, was biaxially stretched 150 per cent in two mutually perpendicular directions. A three inch square reticulated polyester polyurethane foam, 0.080 inch thick, having a density of 2 lb/cu.ft and 20 pores per inch was adhered to the stretched rubber surface with a neoprene rubber solution and a bond was allowed to develop. On allowing the rubber to retract, a 2¼ times surface area reduction was obtained.

The resulting product has a compacted pile-like surface with compressed foam thickness 0.160 inch. There was a pleasant resilient feel to the structure.

The floor coverings of the invention exhibit pile characteristics and the inherent bulking of the cellular material gives a cushioning effect and tends to improve the abrasion- and snag-resistance.

*EXAMPLE II*

The compression in this Example was obtained by means of a light elastic rubber sheet, 0.25 inch thick, having 289 one-inch long 16-gauge metal spikes, 0.75 inch apart, attached to it in an air-tight manner by penetration such that the spikes were perpendicular to the plane of the sheet.

The rubber sheet was biaxially stretched 25% and a 8 inches × 8 inches × 0.25 inch sheet of a reticulated polyester polyurethane foam having 15 pores/linear inch was placed on the spikes so that they penetrated the foam. The rubber sheet was then allowed to retract, thereby reducing the surface dimensions of the foam to 6.4 × 6.4 inches, and the compressed foam was transferred without loss of compression to a spiked metal plate having the same spike-characteristics as the rubber sheet. The compressed foam sheet was heated on the metal plate at 220°C. for 5 minutes and the foam sheet was then released from the plate.

This process was repeated a further three times, each time using the compressed material of the previous time. The sheet dimensions resulting at the end of each of these further processes were 5.4 × 5.4 inches, 4.5 × 4.5 inches and 3.7 × 3.7 inches, respectively.

The final product had a reduction in area of 4.5 times and had pile-characteristics.

WHAT WE CLAIM IS:—

1. A floor covering comprising a surface sheet of a cellular plastics material which has been compressed biaxially by compression forces acting in or parallel to the plane of the sheet and is retained in the compressed state by means of cross-linkage of the plastics material subsequent to compression or by means of an adhesive in the sheet or by heat-setting the plastics material or by means of a sheet material adhered to a face of the sheet.

2. A floor covering according to claim 1 in which the cellular plastics material is a polyurethane foam.

3. A floor covering according to claim 1 in which the cellular plastics material is a foam of poly(vinyl chloride), polyethylene or polypropylene.

4. A floor covering according to claim 2 in which the polyurethane foam is a reticulated polyurethane foam.

5. A floor covering according to any preceding claim in which the thickness of the sheet of cellular plastics material is from 0.04 to 0.25 inch.

6. A floor covering according to any preceding claim in which the degree of compression is the same in both directions.

7. A floor covering according to any preceding claim in which the cellular plastics material has 10 to 40 pores/inch prior to compression.

8. A floor covering according to any preceding claim in which the density of the cellular plastics material prior to compression is up to 6 lb/cu.ft.

9. A floor covering according to claim 8 in which the density of the cellular plastics material prior to compression is from 1½ to 4 lb/cu.ft.

10. A floor covering according to any preceding claim in which the reduction of the surface area of the cellular plastics material resulting from the compression is up to 9 times.

11. A floor covering according to claim 10 in which the reduction of the surface area of the cellular plastics material resulting from compression is from 2 to 6 times.

12. A floor covering according to any

preceding claim in which the cellular plastics material has a coating of another plastics material on at least some of the cell walls.

13. A floor covering according to any preceding claim having an abrasion-resistant polymer finish.

14. A method of making a floor covering which comprises compressing biaxially a surface sheet of a cellular plastics material by compression forces acting in or parallel to the plane of the sheet and retaining the structure in its compressed state by means of cross-linkage of the plastics material or by means of an adhesive in the sheet or by heat-setting the plastics material or by means of a sheet material adhered to a face of the sheet.

15. A method according to claim 14 in which the cellular plastics material has the characteristics described in any one of claims 1 to 13.

16. A method according to claim 14 or 15 in which compression of the sheet is achieved by stretching an elastic sheet material, adhering the sheet of cellular plastics material to the stretched sheet and releasing the stretching forces on the elastic sheet.

17. A method according to claim 16 in which adherence of the sheet of cellular plastics material to the stretched elastic sheet is achieved by means of an adhesive composition.

18. A method according to claim 16 in which adherence of the sheet of cellular plastics material to the stretched elastic sheet is achieved by means of spikes protruding from the elastic sheet.

19. A method of making a floor covering substantially as described in Example I.

20. A method of making a floor covering substantially as described in Example II.

21. A floor covering when made by the method according to any one of claims 14 to 17 and 19.

22. A floor covering when made by the method according to claim 17 or 19.

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